

## CS118 Sample Final Exam

Notes:

1. Be **brief** and **concise** in your answers. Answer only within the space provided. Use the back pages for scratch paper. Cross out your scratch work when you submit your exam paper.
2. If you wish to be considered for partial credit, show *all* your work.
3. The exam is 9-page long. Make sure that you have 10 pages (including this page) before you begin.

PROBLEM	MAX SCORE	YOUR SCORE
1	16	
2	21	
3	12	
4	10	
5	10	
6	12	
7	10	
8	9	
TOTAL	100	

**DO NOT TURN TO THE NEXT PAGE UNLESS YOU GET PERMISSION !!**

**Problem 1 Multiple choices with justifications** (16 points; 2 points each) Select the correct answer(s) from the given five choices, and justify your choice in *NO MORE THAN 20 words*.

1. What is the value of the Time-to-live (TTL) field in an IGMP query message?

- Your answer \_\_\_\_ (A) 0 (B) 1 (C) 2 (D) greater than 2 but less than  $\infty$  (E)  $\infty$
- Justification:

2. Which of the following statement about addressing is true?

- Your answer \_\_\_\_ (A) An IP router can have multiple IP addresses. (B) A host cannot have multiple IP addresses. (C) Ethernet uses hierarchical addressing. (D) Multicast address is used on a per-host basis instead of per-group basis. (E) Internet control message protocol (ICMP) protocol is used to resolve the mapping of IP address and Ethernet address.
- Justification:

3. Which of the following protocols does not use timers?

- Your answer \_\_\_\_ (A) ARP; (B) CSMA/CD; (C) IGMP; (D) TCP; (E) None of the above.
- Justification:

4. Which of the following statement on IPv6 and IPv4 is wrong?

- Your answer \_\_\_\_ (A) IPv6 provides a much larger address space than IPv4. (B) Both IPv4 and IPv6 support fragmentation and reassembly of large packets. (C) IPv6 adds a flow-label field to support quality of service. (D) IPv6 allows Options in the next header field. (E) IPv6 header does not have a header checksum field.
- Justification:

5. Which of the following statement on distance vector routing is wrong?

- Your answer \_\_\_\_ (A) It can be used to compute the shortest path between two given nodes. (B) Every node exchanges route information with its neighbors. (C) In distance routing protocol, good news travels very fast. (D) Distance routing protocol suffers from count-to-infinity problem. (E) Distance vector routing will not work at all when a node fails.
- Justification:

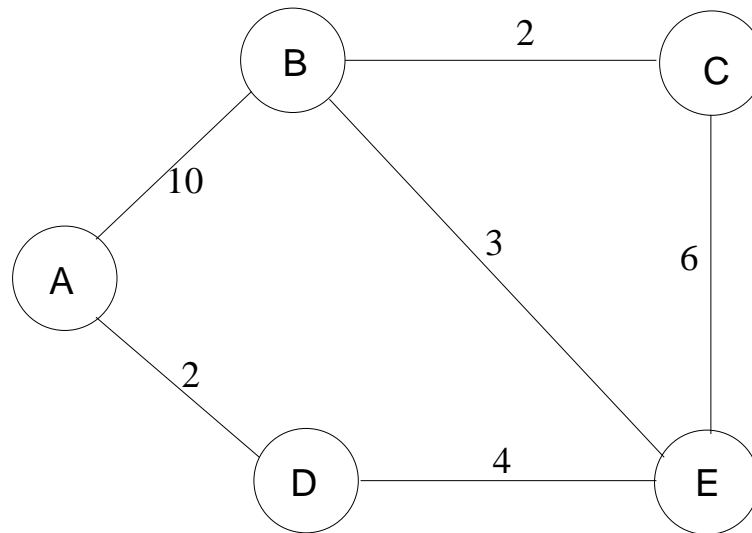
6. If an Internet Service Provider (ISP) wants to implement its own routing policies, which routing protocol should be selected?
- Your answer \_\_\_\_ (A) RIP; (B) OSPF; (C) distance-vector routing; (D) link-state routing; (E) BGP.
  - Justification:
7. Which service model do you select to support videoconferencing for a national security conference?
- Your answer \_\_\_\_ (A) Controlled-load service; (B) Guaranteed quality of service; (C) differentiated service; (D) best-effort service; (E) web service.
  - Justification:
8. Which of the following statement is correct?
- Your answer \_\_\_\_ (A) Hub can be used to connect a 10Mbps Ethernet and a 1Gbps Ethernet. (B) Bridge needs the spanning tree algorithm to prevent cycling and multiplying of frames. (C) Bridge does not implement a self-learning feature. (D) Switches can be used to connect Ethernet and ATM networks. (E) Both switch and router are network-layer devices.
  - Justification:

**Problem 2 (21 points; 3 points each):** Answer the following questions. Be brief and concise.

1. Give two reasons why we need the Internet Control Message Protocol (ICMP). Is the ICMP protocol designed to make IP packet delivery reliable?
2. Can a multicast router using IGMP protocol know how many receivers are associated to a specific multicast group? Briefly justify your answer.

3. Before it knows the mean round-trip time, TCP must be prepared to retransmit the first SYN packet in case it gets lost. How long should TCP set the initial retransmission timer? Our friend John Smart believes that the default retransmission time must be as short as possible (e.g. 0.1 second) so that retransmission happens quickly in case of losses. Do you agree or disagree? Explain.
4. What are the four principles to provide quality of service over the future Internet?
5. Identify at least an advantage and a disadvantage of interleaving and forward-error-correction (FEC), respectively, to recover from packet loss in an Internet phone applications.
6. Describe the three differences between HTTP and SMTP protocols.
7. Which device do you select to connect a 10Mbps Ethernet and an IEEE 802.11b wireless LAN (operating at the infrastructure mode that connects all the access points via 100Mbps Ethernet)?

**Problem 3** (12 points): Consider the network topology shown below.



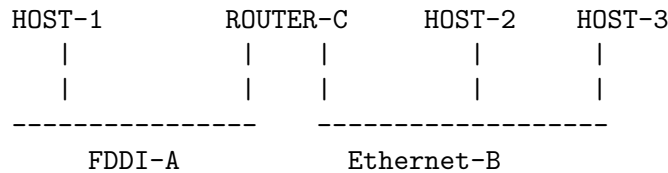
1. By using a table below, create a shortest path routing table from node *A* to all other nodes using the link state (i.e., Dijkstra) algorithm.

step	N	$D(B), p(B)$	$D(C), p(C)$	$D(D), p(D)$	$D(E), p(E)$
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2. Now if link BE fails (i.e., the link cost for BE is infinite), how does the link-state routing respond to this link failure? Compute the new routes and show your steps.

**Problem 4 (10 points):**

List and explain the sequence of all the possible events that may occur when Host-1 128.174.34.55 on FDDI network A sends a 4300-byte IP multicast packet (4300 bytes are the payload, excluding the IP header) to Host-2 128.174.33.23 and Host-3 128.174.33.24 on Ethernet B, assuming that A and B are interconnected by a router C, as shown below. The multicast group for the packet delivery is 225.1.1.1.



	IP address	subnet mask	MAC address
HOST-1	128.174.34.55	255.255.255.0	11.41.0.a0.c5.21
HOST-2	128.174.33.23	255.255.255.0	81.0.2b.e4.b1.20
HOST-3	128.174.33.24	255.255.255.0	32.0.2b.e4.b1.22
C's interface on network A			
	128.174.34.73	255.255.255.0	4a.9b.6.57.0.62
C's interface on network B			
	128.174.33.34	255.255.255.0	3b.a0.11.32.6.34

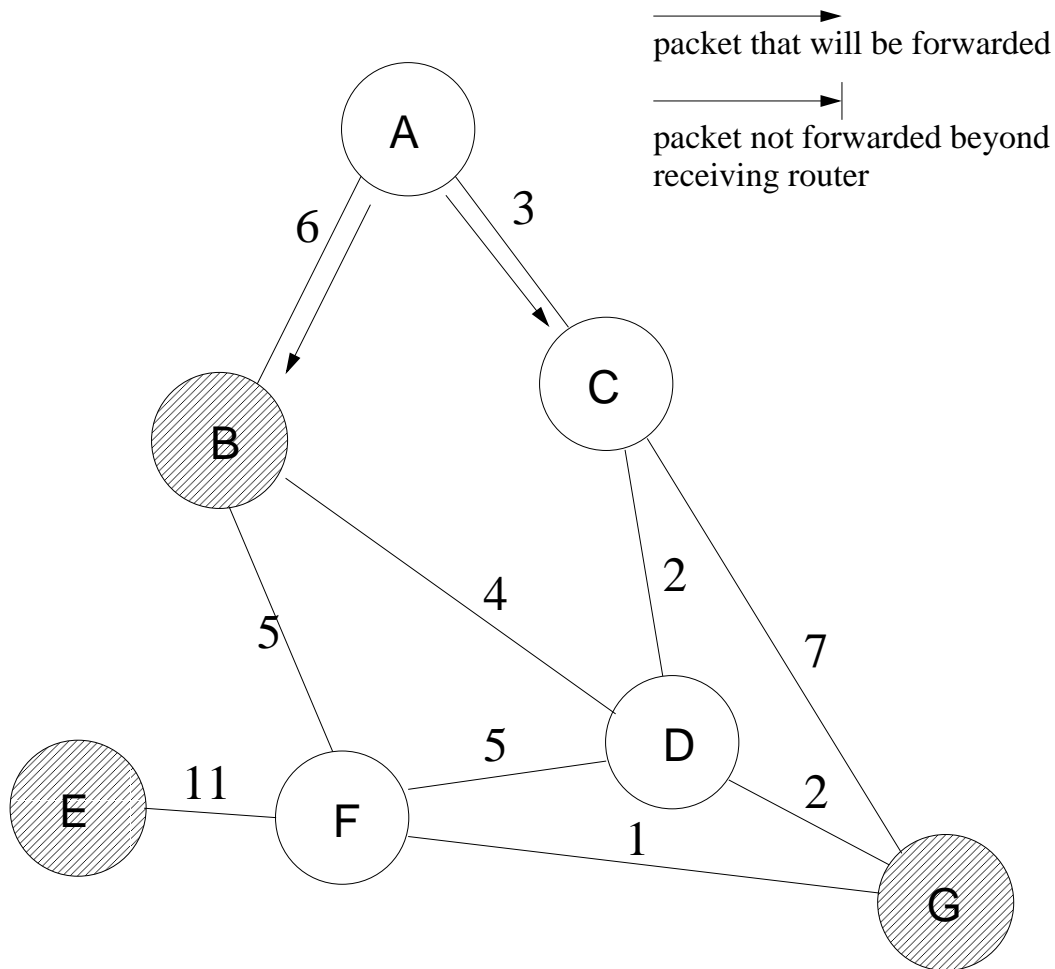
You must give a clear list of events in sequential order. For each event, use no more than 3 lines describing what it is and what it does (omit details that take more space to describe)  
(MAC address: both Ethernet address and FDDI address are 48-bit long and called MAC layer addresses) (Hint: MTU=1500 bytes for Ethernet, and MTU=4500 bytes for FDDI)

**Problem 5 (10 points):**

Network topology is shown below. All routers are capable of multicast routing. A host connected to router *A* sends out a multicast packet into the network. *B*, *G*, and *E* are routers with attached group member of the multicast packet.

1. (10) Using the same notation as the textbook, show how the multicast packet is delivered through the network using the RPF (Reverse Path Forwarding) algorithm.

(Don't mark on diagram until you are confident with the result. The result diagram must be clearly legible.)



2. (5) If we send the same multicast packet as in (a) using multiple unicasts to *B*, *G*, and *E*, what is the total transmission cost? Based on the result, explain the advantages and disadvantages of multicast routing as compared with multiple unicasts.

**Problem 6 (12 points):**

For the following scenario, please design a medium access control (MAC) protocol that provides the best performance. You need to: (1) identify your selected MAC; (2) briefly explain how it works; and (3) briefly justify your answer. (Hint: You can consider TDMA, CSMA/CD, CSMA/CA, Aloha, Slotted Aloha, Token-passing, and polling, etc.)

1. 10 periodic, uncompressed video traffic sources, each of which comes from a laptop. All 10 laptops are sharing a single cable. The video packets produced by each source are of identical size and they arrive at regular intervals.
2. 15 hosts are connected via a cable. Each of them generates bursty, data traffic.
3. 20 laptops and PDAs sharing the radio channel. Each is used to check for emails and browse the web.
4. Now you can use a node to serve as a master node. You are required to design a MAC to support ten (compressed) variable-data-rate video traffic sources. Each source produces approximately constant-bit-rate traffic within a 150-ms interval, but the traffic rate changes every 150-ms interval.



**Problem 7 (10 points):** Assume that the maximum tolerable delay jitter by an Internet phone application is 300ms. Consider the scenario where an Internet phone conversation is ongoing. The maximum jitter that Internet delivers the audio packets for this conversation is 50ms, but the loss percentage for packet delivery is 5% on the Internet route. Design a solution that reduces the jitter and minimizes the playout loss best. (Hint: you may need to allow a limited number of retransmissions for the lost packets).

**Problem 8 (9 points):** Describe your solution to deploying the Mobile IP solution at ten machines on the current IPv4 Internet. You need to explain how your solution addresses the incremental deployment issue and how it enables roaming hosts to keep the ongoing TCP connection without disruption.